

HOSPITAL AND MEDICAL FACILITIES SERIES
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THE PROGRESSIVE PATIENT CARE HOSPITAL

Estimating Bed Needs

A report based on
findings of a Hill-Burton
intramural research project

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Foreword

The material presented in this publication is based on the findings of a study of progressive patient care at Manchester (Connecticut) Memorial Hospital, conducted by the United States Public Health Service in 1959-60 as a part of a Hospital and Medical Facilities research project. The variation in patient census in intensive care, intermediate care, and self-care was analyzed, and some general administrative rules for planning the component units were formulated. Other patient care elements such as long-term care and home care were not included in this study.

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Estimating Bed Needs in a Progressive Patient Care Hospital

How does a hospital embarking on a progressive patient care program determine the number of beds it will need for each of the patient care units?

In an attempt to answer this question, foremost in the minds of hospital management considering the introduction of progressive patient care in their institutions, the Public Health Service conducted a 2-year study at Manchester (Connecticut) Memorial Hospital. An analysis of the results shows that such a determination can be made, based on patient utilization experience of the hospital under its traditional pattern of care.

As noted in the publication, "Elements of Progressive Patient Care,"¹ the need to determine bed requirements is only one of the essential steps to be considered by hospitals contemplating such a program. Other steps enumerated in the publication's *Summary Checklist* (see Appendix, p. 16) also relate to the development of plans for patient care units. Of particular interest are those steps involving the establishment of principles and objectives of each unit and the need for changes in architectural design and equipment. Thus, careful consideration should be given this entire checklist before attempting to estimate bed needs.

The Manchester study was carried out in two phases:

Phase I--An evaluation of patient census based on care requirements.
Phase II--The computation of bed needs for each care unit.

Phase I incorporated such activities as the development of patient-condition checklists, criteria for admission and transfer, and a review of patients to determine to which unit they would be assigned if the hospital were organized in accordance with the progressive patient care concept.

Phase I

Evaluation of Patient Census

Based on Care Requirements

Four major steps are to be considered under Phase I:

1. Designate a patient evaluation team.
2. Develop a patient-condition checklist.
3. Determine criteria for patient classification (i.e., intensive care, intermediate care, or self-care).
4. Evaluate and classify patients.

STEP 1.--Designate a Patient Evaluation Team

A preliminary step is to appoint a patient evaluation team consisting of members of the nursing and medical staffs. The hospital administrator may also be included on this team which will be responsible for steps 2 thru 4. The final step includes orienting the nurses in the application of the checklist.

STEP 2.--Develop a Patient-Condition Checklist

The intensity of a patient's illness is usually reflected in specific conditions calling for specific kinds of treatment. Thus, it is necessary that a patient-condition checklist be developed which would readily indicate the kind of care required by the patient. (It is presumed that the hospital has already clearly defined the principles, objectives, scope, and responsibility of each patient care unit as noted under Item 3 of the Summary Checklist.)

The patient-condition checklist should be sufficiently detailed to enable the team to reach an objective decision as to the unit in which the patient would be provided the most appropriate care. (See "Elements of Progressive Patient Care" ^{1/} for definition of each unit.) The checklist should incorporate the broadest aspects of the patient's needs which should then be related to specific conditions.

As a first step, for example, the following general needs might be considered:

1. Need for nursing observation of physical signs and changes in clinical conditions.
2. Need for physical assistance.
3. Need for special medical or nursing skills and/or special equipment.

Within each of these basic patient need factors are different degrees of need which are then related to specific patient conditions. In this fashion a patient-condition checklist can be produced which will enable the patient to be classified, on the basis of his condition, for assignment into the most appropriate care unit. Items which would be included under the three need factors noted above follow:

1. Need for nursing observation of physical signs and changes.
 - a. Temperature, pulse, respiration (and/or blood pressure)
 - b. Hemorrhage
 - c. Consciousness
 - d. Orientation
 - e. Isolation
2. Need for physical assistance.
 - a. Bathing
 - b. Mobility
 - c. Dietary
3. Need for special medical or nursing skills and/or special equipment.
 - a. Oxygen therapy
 - b. Transfusion and/or infusion
 - c. Suction
 - d. Pacemaker, defibrillator, or respirator
 - e. Stimulants

While this list is somewhat comprehensive, it is by no means exhaustive, and the individual hospital may wish to add to or delete conditions from it.

Some of these patient conditions exist in varying degrees of intensity. For example, hemorrhage may or may not be present; stimulants (levophed or aramine) may or may not be needed; or a patient may or may not need to be fed. The different levels of intensity for each of the patient conditions should be incorporated into the checklist. One method for setting up such a checklist is shown in chart 1.

STEP 3.--Determine Criteria for Patient Classification

The patient evaluation team should agree on those patient conditions, or combination of conditions, which will constitute the criteria for admission to, or discharge from, a patient care unit. The team should regard each patient condition as a factor to be considered in determining the most appropriate care unit to assign a patient. For example, the requirement that temperature, pulse, and respiration be measured every 15 minutes may be considered sufficient reason (i.e. compelling indicator), for assignment to the intensive care unit. On the other hand, if a patient should be found to need oxygen, this requirement would contraindicate assignment to the self-care unit.

Three weights may be used in classifying patients: compelling indicator, moderate indicator, and contraindicator. One of these three weights should be assigned to each patient-condition and level of intensity. The team should ask the question: Is the intensity of the condition a compelling, moderate, or contraindicator for assignment to the intensive care, intermediate care, or self-care unit? When the entire list of patient conditions is thus weighted, it is then possible to establish rules for the admission to, and discharge from, a specific unit.

Evaluation Criteria	Patient Number or Name											
	Date											
TPR and/or BP	Q5min, to Q2h Q4h to QD											
HEMORRHAGE	Present Not present											
LEVOPHED/ ARAMINE	Needed Not needed											
CONSCIOUSNESS	Unconscious Conscious											
ORIENTATION	Disoriented Oriented											
BATH	By nurse Bathes self											
MOBILITY	Confined to bed Ambulatory in room only Ambulatory unlimited											
DIETARY	Fed by nurse Feeds self											
OXYGEN	Needed Not needed											
SUCTION	Needed Not needed											
INFUSION or TRANSFUSION	Needed Not needed											
PACEMAKER or RESPIRATOR	Needed Not needed											
ISOLATION	Yes No											
Unit Assignment												

Chart 1. Patient-condition checklist.

The following criteria are suggested as a basis for determining patient assignment:

- a. One compelling indicator for intensive care is sufficient reason for assignment to the intensive care unit.
- b. Four or more moderate indicators for intensive care constitute sufficient reason for assignment to that unit.
- c. If there is no justification for assignment to intensive care, and in the presence of a contraindicator for self-care, the patient is automatically assigned to intermediate care.
- d. In the absence of moderate indicators for either intensive or intermediate care, and in the absence of a contraindicator for self-care, assignment is to self-care.

The above criteria may be modified to meet the needs and practices within a hospital as determined by the patient evaluation.

STEP 4.--Evaluate and Classify Patients

Upon development of a satisfactory patient classification checklist, the nursing personnel should be trained in its use and application.

To effectively use the checklist, each patient should be observed and his condition noted on the checklist at some designated hour convenient to the nursing staff. The form shown in chart 1 can be used as a checklist if a record of the patient's condition during his entire hospitalization is desired. The factors listed are not intended to give a definitive description of patient condition, but only to be the lowest number of factors which are determinants of classification.

If patient observations are to be made only once in 3 or 4 days, such a form can be used by listing the patients on the date line at the top so that all patients are classified on one form. The checklists should be forwarded upon the patient's discharge or daily, to the data processing center within the hospital. Processing may be manual or mechanical.

Assessment Criteria

		Inten-	Inter-	Self-		
		sive Care(A)	mediate Care(B)	Care(C)		
TPR and/or BP	Q5min. to Q2h Q4h to QD	X				
HEMORRHAGE	Present Not present	X				
LEVOPHED/ ARAMINE	Needed Not needed	X				
CONSCIOUSNESS	Unconscious Conscious					
ORIENTATION	Disoriented Oriented					
BATH	By nurse Bathes self					
MOBILITY	Confined to bed Ambulatory in room only Ambulatory unlimited					
DIETARY	Fed by nurse Feeds self					
OXYGEN	Needed Not needed					
SUCTION	Needed Not needed					
INFUSION or TRANSFUSION	Needed Not needed					
PACEMAKER or RESPIRATOR	Needed Not needed	X				
ISOLATION	Yes No					
	Unit Assignment					

X Compelling Indicator

\\ Moderate Indicator

|| Contraindicator

Chart 2. Coding overlay for patient-condition checklist (Chart 1).

For use, the dotted boxes should be cut out.

in this patient care unit may then be applied. A similar procedure would be used for the self-care unit assignment by shifting the overlay to this column.

The appropriate patient care unit assignment may then be noted through the overlay on the patient condition checklist. It is suggested that each of the care units be designated by a simple code (A, B, and C) in order to meet space requirements.

The assignments made on this basis should be reviewed for overriding considerations of policy. For example, a patient in intermediate care expected to be discharged the next day, if found to be in self-care state, would most likely not be transferred to a self-care unit.

NUMBER OF PATIENT OBSERVATIONS

The method to be proposed for estimating bed needs requires some reliable estimates of average patient census in the units. The greater the number of days that census observations are made, the more precise the estimate of average census in each of the care units. The hospital patient population should be observed over a period of time to determine the average census for the intensive care, intermediate care, and self-care units. A suggested sampling plan is presented below:

The readings of census used for estimating average census should be spaced a number of days apart so that the count on any day is independent of the census on the day of previous observation. If the census observations are made until a total of 400 intensive care patient days are counted, there would be approximately 95 percent assurance that the observed daily average census is within 10 percent of the true average during the sampling period. To increase the precision of estimate to 5 percent with the same degree of confidence would require a sample size of 1,600. The value of the additional 5 percent precision gained from quadrupled sample size is doubtful.

Phase II

Estimating Size of Care Units

The method which follows for computing bed needs in the various care units will provide for variations in census. Since the estimated census is a simple average, there will be some variation around that average. Therefore, some flexibility in the allocation of beds should be built into a progressive patient care system.

One way of achieving such flexibility is through interchangeability, i.e. providing some beds which may accommodate either intensive or intermediate care patients, and similarly some beds which may accommodate either intermediate care or self-care patients, as the situation demands. For example, the number of beds for intensive care should be adequate for a high intensive care load, yet useful at other times for less seriously ill patients. The flexibility implied here needs to be of such a nature that when the intensive care census is low, the empty beds of the unit can be used for other purposes. In like manner, when intensive care census is unusually high, flexibility implies that suitable facilities are available. The concept is implemented through provision of basic units, designed to house only one class of patient, adjacent to flexible areas.

CALCULATION OF BED REQUIREMENTS

If the basic size of the intensive and intermediate care units is made equal to the estimated average census for these units the occupancy rate in these basic units will be approximately 90 percent. The computation of the number of flexible beds is based on statistical and administrative assumptions developed in the field of operations research.^{2/} The recommended reserve is sufficient to contain the census on all but one day a month and is given in Table I. The recommendation is similar in nature to that of the Commission on Hospital Care (1946) and Blumberg (1961).^{3/ 4/} Accordingly, the estimated average census of the intensive care units provides the basis for the number of flexible beds between the intensive and the intermediate care units. Similarly, the sum of the average census for the intensive and the intermediate care units provides the basis for the total flexible beds for the entire hospital.

Included below are step-by-step directions for calculating the number of flexible beds and the size of the patient care units. The procedure is based on the theory that intensive care patients preempt the beds in the flexible zone between intensive and intermediate care, and that intermediate care patients preempt the flexible zone between intermediate care and self-care. To facilitate these calculations Table I has been provided to show the average census from 3 to 240 patients and the corresponding size of the flexible care zone(s).

Table I. - AVERAGE CENSUS AND FLEXIBLE BEDS*

Average Census	Flexible Beds	Average Census	Flexible Beds
3	3	34	12
4	4	40	13
5	4	47	14
6	5	53	15
7	5	61	16
8	6	69	17
9	6	77	18
10	6	86	19
11	7	96	20
12	7	106	21
13	7	116	22
14	7	127	23
15	8	139	24
16	8	151	25
17	8	163	26
18	8	176	27
19 - 22	9	190	28
23 - 27	10	204	29
28 - 33	11	218	30
		233	31

* Number of flexible beds for average census below 25 taken from E. C. Molina, "Poisson's Exponential Binomial Limit," 1942. The number of flexible beds for an average census above 25 is approximately twice the square root of the average census.

The steps follow:

STEP 1. - The size of the basic intensive care unit is set as equal to the average census of intensive care patients. (The assumption here is that this average census can be used as a basis for predicting future census.)

STEP 2. - The size of the flexible care zone between the intensive care and the intermediate care units is obtained by consulting Table I for the figure corresponding to the estimated average census for the intensive care unit.

STEP 3. - To obtain the total number of flexible beds of the entire hospital, the estimated average census for the intensive care and the intermediate care units are combined. Again consult the table and obtain the figure which corresponds to this sum.

STEP 4. - The number of flexible beds between the intermediate care and the self-care units will next be determined. This is done by subtracting the number of flexible beds between the intensive and the intermediate care units (step 2) from the number of flexible beds for the entire hospital (step 3).

STEP 5. - Determining the number of beds in the basic self-care unit is the final step. This number is equal to the difference between the total bed capacity of the hospital and the sum of the following:

- a. estimated average census of the intensive care unit.
- b. estimated average census of the intermediate care unit.
- c. total flexible beds as determined in step 3 above.

The number of basic self-care beds is somewhat arbitrary. Since this segment of the census is largely elective, the laws of probability which affect the other census are not operative and administrative policy can dominate.

EXAMPLE OF ESTIMATING SIZE OF CARE UNIT

Assume, as an example, that a 150-bed existing hospital operates at 87 percent of capacity. This is in keeping with the underlying philosophy of progressive patient care which assumes a relatively high occupancy. Assume further that the hospital has conducted several months of observation and classification of patients and finds the estimated census divided as follows:

<u>Patient care unit</u>	<u>Average patient census</u>
Intensive care	15
Intermediate care	85
Self-care	30

In accordance with the procedure outlined above, the following calculations are made:

STEP 1. - The number of basic intensive care beds and flexible beds between the intensive and the intermediate care units is first obtained. Consulting Table I for the average census of the intensive care unit of 15, the corresponding number of flexible beds is 8.

STEP 2. - The total flexible beds for the entire hospital is next determined by combining the estimated average census for the intensive care and the intermediate care units, resulting in a sum of 100. Consulting Table I, the total flexible beds is 20.

STEP 3. - The number of flexible beds between the intermediate care and the self-care units is the difference between step 2 and step 1, or 20 minus 8 equals 12 flexible beds.

STEP 4. - Finally, the basic size of the self-care unit is determined. This is equal to the difference between the total available bed capacity, 150, and the sum of the following:

- a. Estimated average census for the intensive care unit 15
- b. Estimated average census for the intermediate care unit 85
- c. Total flexible beds for the entire hospital 20

T20

Therefore, the size of the basic self-care unit in the example is 30 beds.

The results of this example are summarized below:

Basic size of the intensive care unit	15 beds	
Flexible care beds		8 beds
Basic size of the intermediate care unit	85 beds	
Flexible care beds		12 beds
Basic size of the self-care unit	30 beds	
	130	20

If the procedure were carried a step further it could be assumed that the average census of 130 patients should have, according to Table 1, a total of 130 + 23, or 152 beds in order to give the same protection against shortage of beds for self-care patients as the others. However, the additional beds are not cited in the above example since the statistics here are based on the assumption of no administrative deferral of admissions. Such deferral is acceptable in the case of self-care patients.

Conclusion

The essence of the procedures outlined above is that variability in patient census in the patient care units is a factor which determines bed needs for a progressive patient will be refinements of the methods proposed above patient care concept.

Appendix

The Progressive Patient Care Concept

Listed below are excerpts from the publication, "Elements of Progressive Patient Care."¹

The Purpose

The principal objective of progressive patient care is to provide better treatment and care by organizing hospital services around the individual patient's medical and nursing needs. Specially planned and organized units are set up to which patients are assigned in accordance with their degree of illness and need for care. Many factors must be considered. For example, nurses and other personnel are selected for their ability to provide the kinds of services needed by each group of patients. Organizational patterns and policies must be developed to facilitate the smooth operation of the program. Various physical facilities within the hospital must also be adapted to conform with the program needs.

The Elements

Progressive patient care is a dynamic concept with application to hospitals of all sizes and types. At least six elements are incorporated in the progressive patient care concept. These include: intensive care, intermediate care, self-care, long-term care, home care, and outpatient care. The essentials of each may be considered as follows:

Intensive care.--For critically and seriously ill patients who are unable to communicate their needs or who require extensive nursing care and observation. These patients are under close observation of nurses who have been selected because of their special skills, training, and experience. All necessary lifesaving emergency equipment, drugs, and supplies are immediately available.

Surgical postoperative recovery room services logically fall within this general category. Detailed exploration of this subject area, however, is omitted from this publication since it is a well-defined and developed concept, discrete and organizationally independent of general nursing services and medical care. For purposes of this discussion, therefore, it is considered as a separate entity.

Intermediate care.--For patients requiring a moderate amount of nursing care. Some of these patients may be ambulatory for short periods of time. Emergency care and frequent observation are rarely needed. Included in this group are those patients who are beginning to participate in caring for themselves. In addition, the terminally ill may be cared for here.

Self-care.--For ambulatory and physically self-sufficient patients requiring therapeutic or diagnostic services, or who may be convalescing. In this homelike atmosphere, provision is made for relaxation and recreation. Here the patient is instructed in self-care within the limits of his illness.

Long-term care.--For patients requiring skilled prolonged medical and nursing care. Rehabilitation, occupational therapy, and physical therapy services may be needed for these patients. In addition, emphasis is placed on instructing those patients who must learn to adjust to their illness and disability.

Home care.--For patients who can be adequately cared for in the home through the extension of certain hospital services. A hospital-based home care program provides personnel and equipment from the hospital or through community agencies, such as the local health department or the Visiting Nurse Association. The hospital, however, usually assumes responsibility for coordinating the services, whether they are furnished by the hospital or another agency.

Outpatient care.--For ambulatory patients requiring diagnostic, curative, preventive, and rehabilitative services. This element is historically a generally accepted activity of the average hospital. It usually functions on a discrete organizational basis and its utilization varies with local circumstances, including patterns of medical practice.

Hospital beds are not always available in sufficient numbers, nor are they indicated for all who need diagnostic and therapeutic services. Adequate care in well-organized outpatient departments fills the need in considerable measure.

The Benefits

Hospitals which are successfully practicing progressive patient care report that the benefits are manifold. They extend to the patient, the physician, the nurse, and those involved in the hospital's operation. Some of the primary advantages for each include:

• The patient receives the specialized attention he needs when he needs it. Moreover, he is assisted in making his adjustment first to the hospital atmosphere and later to his return to the home and community.

Some of the hospital's objectives are to provide the following: lifesaving care within seconds; constant nursing care when needed the most; high-quality care regardless of economic status; total (physical, teaching, emotional, rehabilitative) services when needed; and nursing care which is planned around progress toward recovery.

• The physician is given greater assurance that his patient is receiving a high quality of nursing care, and that the special drugs, medications, and equipment necessary for diagnosis and treatment are in the immediate vicinity of the patient. Moreover, there is greater likelihood that a bed will be available and that trained personnel will be on duty who will contact the physician immediately in emergencies and carry out procedures

as required. Emergency orders may be carried out without upsetting the entire routine as the personnel are geared mentally and physically to cope with these problems.

Since early involvement of the physician in setting up PPC is essential, he is made more aware of the hospital's problems and policies. This creates better understanding and promotes better clinical services, team action, and administration.

• The nurse makes effective use of her special capabilities, and the nursing department is less harassed by problems of providing coverage for critically ill patients in widely separated areas. Progressive patient care permits the assignment of nurses to the area where their individual skills can best meet the needs of the patient. Nurses have more time to spend with patients on nursing, and, as contributing members of a health team, are able to help patients and families solve their health problems.

The conventional nursing unit usually separates patients by type of service, age or sex, and the patient often remains on the same unit during the various stages of his illness. His likelihood of receiving complete physical care when he needs it the most is decreased. When he makes some progress and is ready for instruction, emotional support, and rehabilitation, the demands of other critically ill patients must be given priority. The patient often is left with the feeling of being neglected, and his progress toward full recovery may be retarded.*

Progressive patient care, through the organization of services and skills based on the needs of patients, can help to make comprehensive specialized nursing care available to patients during different stages of illness. Since nursing supervisors, head nurses, and team leaders work closely together in planning for total patient care, coordination of patient care emerges as a major responsibility of the professional nurse. Moreover, the nurse has an opportunity to utilize her competencies more effectively and thereby acquire greater job satisfaction.

• The hospital has an opportunity for enhancing the quality of patient care as a result of effective and efficient use of personnel, beds, physical facilities, equipment, supplies, and funds. Better utilization of better trained personnel

Summary Checklist for Setting Up Progressive Patient Care Program

1. Lay necessary groundwork:

- a. Review all available literature.
- b. Confer with hospitals practicing PPC.
- c. Analyze existing problems and examine ways PPC would be beneficial.

2. Arrange for thorough discussions among hospital staff and board of trustees:

- a. Schedule series of discussions and orientation conferences for physicians, nurses, and other staff members. Through group action, determine the degree to which PPC should be adopted.
- b. Present, with staff assistance and participation, a well-outlined program to board of trustees. Topics should include:
 - (1) Principles and objectives of each patient care unit.
 - (2) Operational policies and procedures.
 - (3) Estimated beds and anticipated changes in design and equipment.
 - (4) Estimated costs and financing.

3. Under joint agreement of the board of trustees and hospital staff, set forth principles and objectives of each patient care unit.

- a. Outline in writing a well-defined description of principles, objectives, scope, and responsibility of each patient care unit.

4. Establish operational policies and procedures.

- a. Form central committee and subcommittees to develop policies and detailed methods and procedures for carrying out program.
- b. Establish criteria and procedures for admitting and transferring patients.
- c. Plan periodic evaluation of functions of each patient care unit to ensure that objectives are being met.
- d. Plan methodical evaluation of quality of individual patient care, including consultations.
- e. Develop needed forms, records, and reports.
- f. Determine procedures for a daily evaluation of

patients. (The medical staff should set forth the criteria which would be used as a basis for the evaluation of each patient to determine whether he should remain on the unit, be transferred to another unit, or be discharged.)

- g. Make provisions for modifications, if necessary, of services to meet the special needs of the patients in each patient care unit; e.g., diagnostic and therapy, dietary, housekeeping and supplies.
- h. Make modifications, if needed, of policies in relation to such factors as visitors, safety, health education for patients, and information program for patients and general public.
- i. Determine the nursing specialties and other competencies needed for each unit and make selection of personnel accordingly.
- j. Orient physicians, nurses, and other personnel regarding policies and procedures of patient care units.
- k. Provide inservice education for physicians, nurses, and others for any new competencies which may be required.

5. Estimate the number of beds needed for each patient care unit and determine what changes are needed in design and equipment.

- a. After careful analysis based on past experience and anticipated future needs, make an estimate of the number of beds needed for each patient care unit, with emphasis on services and flexibility.
- b. Determine location of patient care units, nurses' stations, kitchen location(s), dining areas, utility rooms, toilets, and other necessary facilities.
- c. Determine architectural design and costs for alteration or construction of units.
- d. Determine equipment needs and costs.

6. Estimate cost and plan for adequate financing.

- a. Analyze the cost of operating each unit and the amount to be charged for services.
- b. Make necessary arrangements with third-party payers for patient coverage in various units.
- c. Develop business office records, charges, and collection methods.

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